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ILLEGIB

[redacted]

Dear [redacted] 25X1

Attached is our rough draft proposal less pricing for the AS-3 Base Recognition Unit.

We have changed the approach slightly over the method discussed with you earlier. Again I would like to express our feelings against using the identification dots for recognition. It is the combined opinion of all of the fellows here that this would be a very unsatisfactory method.

Please give my regards to all.

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AS-3 BASE RECOGNITION UNIT

1. Statement

2. Delivery Schedule

3. Government Furnished Property

4. Technical Discussion

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ATTACHMENT #1 TO WORK

Item 1 - The contractor shall engineer and develop an AS-3 base recognition unit, in accordance with the attached technical discussion. This will include construction of the prototype.

Item 2 - The contractor will provide a complete set of commercial type drawings for future production purposes.

Item 3 - Fabricate additional copies of the prototype

Item 4 - Monthly Report

Item 5 - Final Report

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DELIVERY SCHEDULE

Item 1 - Delivery of the prototype delivery unit will be made five (5) months after receipt of contract.

Item 2 - Delivery of production drawings will be made seven (7) months after receipt of contract.

Item 3 - Delivery of additional copies of prototype will be made three (3) months after receipt of contract, but not before two months after completion of item 1.

Item 4 - The monthly report shall be submitted on the first day of each month.

Item 5 - The final report will be delivered two months after completion of Item 1.

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GOVERNMENT FURNISHED PROPERTY

During the course of development and testing of the recognition unit, the following pieces of Government furnished equipment will be required at the Hughes laboratories.

Item	Quantity	Description
1	1	CV-13 Converter
2	2	AS-3 Field Unit
3	1	Audio tape recorder with remote clutch control feature.

[redacted]

Introduction

At the present time, it is necessary for a base station operator to maintain constant watch on frequency when expecting a transmission from an AS-3 or its predecessor Field Units. This technique results in unfortunate limitations of field unit use, restricting transmissions to rather precise signal plan time.

Government engineers have requested that an automatic recognition system be devised such that the base station would automatically recognize the presence of an AS-3 type of transmission and then record the message without operator attendance. This feature would increase the capability of the system by enabling transmissions from the field equipment to be made at any time, within the limitations of the frequency conditions.

Methods

Several recognition schemes have been considered for the program. The simplest scheme, but very unreliable, uses the present operating technique of preceding the message with a series of automatic [redacted]

[redacted] receiver unit would recognize these [redacted] at a predetermined repetition rate and would start the [redacted]. This technique would require no electrical or mechanical [redacted] the AS-3 and would require the construction of one drawer of equipment at the base. The main disadvantage to this technique however, is that it is subject to many false recognitions. For example, a carrier on the channel frequency with an audio tone of the proper frequency would cause false recognition, particularly a varying tone type of jammer. When the base operator is tuning the receiver, the BFO is normally turned on. Each carrier tuned across* would cause a false recognition.

*each carrier modulated by 150 cps

The second recognition scheme is a little more complex, but is a much more reliable system and is almost impervious to false recognitions. This system requires a Barker type of preamble preceding the message from the AS-3. This preamble is in the form of regular [redacted] and dashes. The base receiver integrates this information to [redacted] a positive recognition, [redacted] other type of information being subcontracted out. There are two approaches in incorporating this tech-

spaces

[redacted] system. [redacted] requires the modification of the [redacted] to include a [redacted] generator for this preamble. [redacted] AS-3 case size in one dimension [redacted] room for some additional digital circuits. Thus, the AS-3 [redacted] would press a button to send a message, the preamble being automatically transmitted before the message starts. The second method of incorporating this scheme entails no modifications or additions to the field unit, but does require a slightly more complex [redacted] station recognition unit. This is necessary to accomodate the speed variations likely to occur in the tape drive unit of the AS-3.

As the latter method described above seems to be the most feasible technique, the following paragraphs are devoted to a detailed description of the proposed system.

Barker Symbol Method

As stated above, no changes or modifications of the AS-3 are required for this recognition system; however, the operator must be trained in the preparation of the message to include the necessary preamble information. The operator must precede his message with a

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[redacted]

combination of dots and spaces which form a Barker symbol.

| Space | Dot | Space | Space | Dot | Dot | Dot |

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[redacted]

tion. The number of code patterns to be transmitted is somewhat arbitrary and probably should be best determined by the operational limitations on the transmission time. The advantage to the T/L system described is that a lower signal threshold may be used to take advantage of weak signal strength yet still have the safeguard against false recognitions.

It should be noted here that the code writing unit of the AS-3 provides very stable pulse widths for dots and dashes with equally accurate spacing in between. At the readout speed a dot is 3.33 ms in length, as is the automatic gap following a dot. A dash is 9.99 ms in length, with the automatic gap following of 3.33 ms. The space function which is used between characters is also precise and is 6.66 ms in length.

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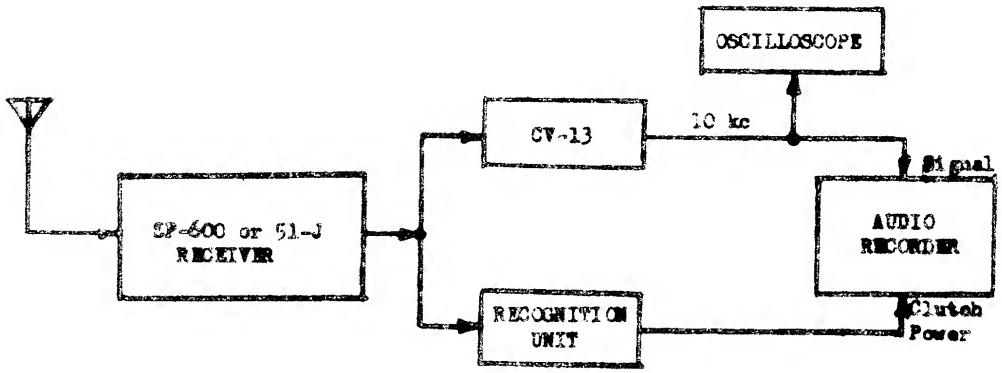

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Figure 1 - Block Diagram

AS-3 Base Receiving Equipment

[redacted]

[redacted] were. These readout pulse width figures are ideal, whereas the [redacted] tape drive motor may vary in speed by ±5%. Therefore, the base station must be made capable of handling this speed variation.

Base Station

The base station equipment will consist of a standard communications receiver, such as the 51-J or SP-600, a CV-13 converter, [redacted] oscilloscope, audio recorder, and a recognition drawer. This equipment is shown in block diagram form in Figure 1.

A CV-13 converter is a device for converting the IF output of communications receiver, normally 455 kc or 50[redacted] kc, to an audio [redacted] of 10 kc. For single side band reception, an artificial carrier is inserted by the converter unit. This feature apparently is not intended for high speed field unit reception as conventional audio [redacted] is obtained for this mode. The 10 kc output is recorded by an audio recorder, the recording then is played back at a slow speed for intelligence.

Two basic types of recognitions systems are under consideration. Both techniques require delay lines for information storage prior to

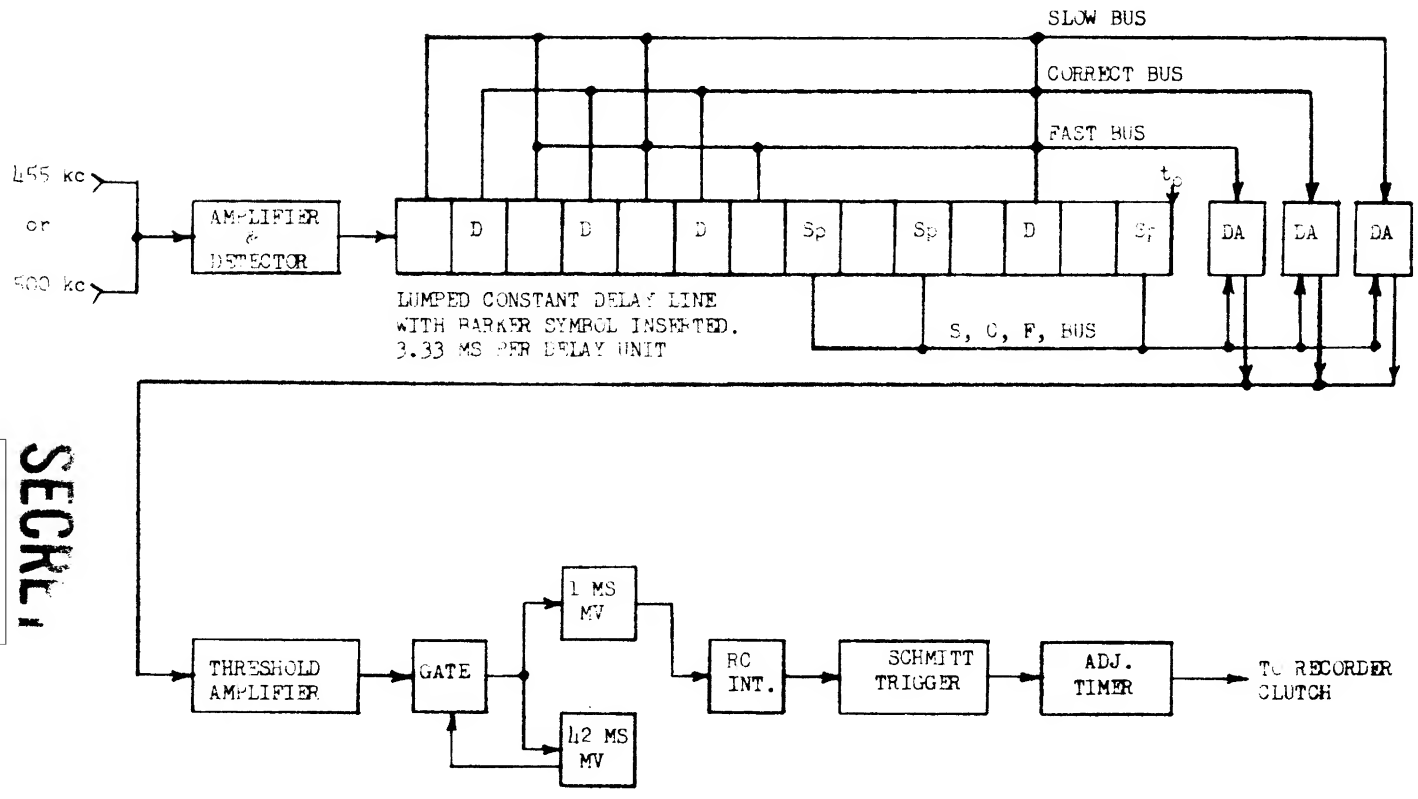

FIGURE 2 - BLOCK DIAGRAM
BASE RECOGNITION UNIT

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[redacted] delay and lumped constant

[redacted]. The latter is comparatively bulky and heavy, but it is more [redacted] than the digital delay. A lumped constant line does strictly analog information, whereas a digital line requires an analog to digi- [redacted] conversion first. As both techniques are similar, the lumped constant techniques will be discussed in the following paragraphs, although some study will be required in order to determine which techniques will be used on the final unit.

The block diagram of the recognition unit, illustrated in Figure 4, shows the communications receiver I-F output feeding an amplifier/ [redacted] detector circuit. This is for illustration purposes only and does not necessarily represent the final circuit. As alternatives, the input circuit may be able to use the 10 kc output from the CV-13 or the receiver audio output. In any case, the lumped constant delay line requires a detected input.

The delay line of Figure 2 consists of 14 delay units; each unit having a delay of 3.33 ms. The special coding is shown inserted into the delay line. The D represents the dot and the Sp the space function.

[illegible] time t_0, therefore, the first part of the coding is at the start end of the line. The first space function is of no consequence because no information is transmitted, but is very definitely required in the following groups to be transmitted for correct timing. A delay unit has been provided in the line for each dot (3.33 ms) and for the automatic gap following a dot (3.33ms) Two delay units are provided for each space function (6.66 ms). The integration process depends on having signal at certain points on the line and no signal at other points on the line. The signal information and the no signal information is summed with add busses. The add lines shown in the illustration are actually resistive add busses, the resistors being adjusted to add equal amounts of signal, or no signal, from each point in the line. Three sets of add busses are used in order to compensate for the ±5% speed variations in the AS-3 tape drive unit. Each code group requires 46.6 ms to transmit at the correct motor speed. A ±5% speed variation represents 2.3 ms variation in transmission time. If a transmission is started at t_0, speed variations are felt most near the end of the 46.6 ms period of time.

Therefore, on the integration line the slow taps have been moved farther away from t_o by 3.33 ms and the fast taps have been moved nearer to t_o by 3.33 ms. (These taps will allow slightly more than a 5% deviation). Each add bus is independent of the other, although the illustration shows them connected together. Each of the add busses connect to the grids of a difference amplifier. For the case of a code group being transmitted at the correct speed, when the code group is fully inserted into the line, four signals will be added together on the grid of the correct difference amplifier and zero signals on the other grid. This represents the greatest difference in levels that can occur on the inputs of the difference amplifier. Should any discrepancy occur in the code arrangement, the relative difference in amplitudes on the grids of the difference amplifier will be less.

Upon receipt of a code group, the difference amplifier output will swing extremely high. An adjustable threshold will determine the amount of output required to recognize a code group. With the threshold exceeded two multivibrators will be tripped. One will have a period slightly less than a code group period (approximately 42 ms),

[redacted] MV blocking off the gate circuit following the threshold. The [redacted]ber MV presents a pulse of known width and amplitude to an [redacted] integrator circuit. The parameters of this circuit will be adjusted such that a Schmitt trigger circuit will be tripped when the proper number of code groups have been received. The Schmitt trigger will start an adjustable timer which will provide power to start the audio recorder. Thus, upon recognition, the recorder will record for a fixed length of time, then will turn off. The purpose of the gate circuit described is to prevent the 1 ms multivibrator from getting tripped more than once by transient extraneous signals that might exceed the threshold. This digital circuitry is similar to that used in the AS-6 base station receive terminal and has proven very satisfactory thus far.

Packaging

The entire recognition unit can be housed in a standard AS-4/AS-4A/AS-6 type of drawer with a panel height of seven to twelve inches. The drawer can be constructed for standard rack mounting with [redacted] hole spacing, or a sliding drawer can be provided whereby the drawer can be pulled forward out of the rack and tilted for servicing. Mounting brac-

mation should be furnished by Government engineers. In addition to the recognition unit, a power supply will be required for providing voltage to the recognition unit. If a digital delay line is used, the supply may be incorporated into the drawer, otherwise a small chassis will be required to house the supply.

Reports

It is anticipated that development work and the construction of a prototype recognition drawer will not require more than six months. Therefore, quarterly reports will not be provided for this program. Progress will be reported in the Monthly Progress Letter covering all Tasks of RD-103. A final report incorporating operating instructions and simple maintenance information will be published at the end of the program.

Drawings

In anticipation of possible production of the recognition unit, complete commercial type drawings will be made. Such drawings will be suitable for the manufacturing of recognition units without further development costs.

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Additional Units

Additional copies of the prototype unit will be laboratory produced on a limited basis if such units are deemed necessary for the evaluation of the system. Quantity production of this unit will be handled by a production facility, based upon available production drawings.

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